

## SULFUR

(Data in thousand metric tons of sulfur, unless otherwise noted)

**Domestic Production and Use:** In 1998, elemental sulfur and byproduct sulfuric acid were produced at 149 operations in 30 States, Puerto Rico, and the U.S. Virgin Islands. Total shipments were valued at about \$450 million. Elemental sulfur production was 9.7 million metric tons; Texas and Louisiana accounted for about 50% of domestic production. Elemental sulfur was recovered at petroleum refineries, natural gas processing plants, and coking plants by 58 companies at 137 plants in 26 States, Puerto Rico, and the U.S. Virgin Islands. Elemental sulfur was produced by one company at two mines in two States, using the Frasch method of mining. Byproduct sulfuric acid, representing 14% of sulfur in all forms, was recovered at 14 nonferrous smelters in 8 States by 10 companies. Domestic elemental sulfur provided 67% of domestic consumption and byproduct acid accounted for 11%. The remaining 22% of sulfur consumed was provided by imported sulfur and sulfuric acid. About 90% of sulfur was consumed in the form of sulfuric acid. Agricultural chemicals (primarily fertilizers) comprised 65% of reported sulfur demand; petroleum refining, 15%; chemicals, organic and inorganic, 7%; and metal mining, 7%. Other uses, accounting for 6% of demand, were widespread because a multitude of industrial products require sulfur in one form or another during some stage of their manufacture.

<b>Salient Statistics—United States:</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998<sup>e</sup></b>
Production: Frasch	°2,960	°3,150	°2,900	°2,820	2,000
Recovered elemental	7,160	7,250	7,480	7,650	7,700
Other forms	<u>1,380</u>	<u>1,400</u>	<u>1,430</u>	<u>1,550</u>	<u>1,600</u>
Total	11,500	11,800	11,800	12,000	11,300
Shipments, all forms	11,700	12,100	11,800	11,900	11,800
Imports for consumption:					
Recovered, elemental	1,650	2,510	1,960	2,060	2,400
Sulfuric acid, sulfur content	696	628	678	659	680
Exports:					
Frasch and recovered elemental	899	906	855	703	900
Sulfuric acid, sulfur content	46	56	38	39	50
Consumption, apparent, all forms	13,100	14,300	13,600	13,900	13,900
Price, reported average value, dollars per ton of elemental sulfur, f.o.b., mine and/or plant	30.08	44.46	34.11	36.06	36.20
Stocks, producer, yearend	1,160	583	639	761	350
Employment, mine and/or plant, number	3,100	3,100	3,100	3,100	3,100
Net import reliance <sup>1</sup> as a percent of apparent consumption	12	21	13	13	18

**Recycling:** About 3 million tons of spent acid was reclaimed from petroleum refining and chemical processes.

**Import Sources (1994-97):** Elemental: Canada, 72%; Mexico, 24%; and other, 4%. Sulfuric acid: Canada, 80%; Germany, 7%; Mexico, 6%; Japan, 4%; and other, 3%. Total sulfur imports: Canada, 74%; Mexico, 20%; Germany, 3%; and other, 3%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations (NTR) 12/31/98</b>	<b>Non-NTR<sup>2</sup> 12/31/98</b>
Sulfur, crude or unrefined	2503.00.0010	Free	Free.
Sulfur, all kinds, other	2503.00.0090	Free	Free.
Sulfur, sublimed or precipitated	2802.00.0000	Free	Free.
Sulfuric acid	2807.00.0000	Free	Free.

**Depletion Allowance:** 22% (Domestic), 22% (Foreign).

**Government Stockpile:** None.

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**Events, Trends, and Issues:** The single remaining domestic Frasch sulfur producer was spun off as an independent entity by its parent corporation early in the year. The newly formed company announced significant production cutbacks at both of its sulfur mines in an attempt to balance the market. The two Frasch mines operated in the Gulf of Mexico and in west Texas. Production at the offshore mine was also adversely affected by two hurricanes that hit the Gulf Coast region in September, during which the platform was evacuated and production ceased. Damage to the mine as a result of the second storm severely restricted production during the fourth quarter. Although the company planned to close the Texas mine in September, it continued to operate at a reduced rate in an effort to offset production lost in the Gulf. Recovered sulfur producers were also affected by the hurricanes, but damage was not extensive.

Because of production cutbacks at Frasch operations, total elemental sulfur production was 7% lower than in 1997. Shipments, however, were nearly the same as in the previous year because of an aggressive remelting program undertaken by the Frasch producer to meet its sales contract requirements. By yearend, total domestic producers' sulfur stocks were less than one-half of what they were at the end of 1997. In general, the domestic market was relatively tight, even with increased imports. Domestic prices were steady throughout the first three quarters of the year, with a small increase at yearend.

Domestic Frasch sulfur production is expected to level off at about 2 million tons after the Texas mine closes and the offshore mine recovers from its technical problems. Production should remain at that level throughout the lifetime of the mine. Production of recovered elemental sulfur will continue its steady growth, with most of the growth coming from petroleum refining. Recovered sulfur from natural gas processing is expected to stay relatively level. The amount of byproduct sulfuric acid produced will be closely tied to the performance of the copper industry. High levels of copper production will result in increased acid production. Apparent consumption of sulfur in all forms is projected to be steady at about 13.9 million tons in 1999.

### **World Production, Reserves, and Reserve Base:**

	Production—All forms		Reserves <sup>3</sup>	Reserve base <sup>3</sup>
	1997	1998 <sup>e</sup>		
United States	12,000	11,300	140,000	230,000
Canada	10,200	10,200	160,000	330,000
China	6,750	6,500	100,000	250,000
France	1,110	1,100	10,000	20,000
Germany	1,130	1,110	NA	NA
Iran	900	900	NA	NA
Iraq	450	450	130,000	500,000
Japan	2,800	2,800	5,000	15,000
Kazakhstan	945	1,000	NA	NA
Mexico	924	925	75,000	120,000
Poland	1,820	1,800	130,000	300,000
Russia	3,750	3,750	NA	NA
Saudi Arabia	2,000	2,000	100,000	130,000
South Africa	570	570	NA	NA
Spain	761	750	50,000	300,000
Other countries	<u>7,500</u>	<u>8,800</u>	<u>500,000</u>	<u>1,300,000</u>
World total (may be rounded)	53,600	54,000	1,400,000	3,500,000

**World Resources:** Resources of elemental sulfur in evaporite and volcanic deposits and sulfur associated with natural gas, petroleum, tar sands, and metal sulfides amount to about 5 billion tons. The sulfur in gypsum and anhydrite is almost limitless, and some 600 billion tons are contained in coal, oil shale, and shale rich in organic matter, but low-cost methods have not been developed to recover sulfur from these sources. The domestic resource is about one-fifth of the world total. Elemental sulfur deposits have become marginal reserves unless the deposits are already developed. Sulfur from petroleum and metal sulfides may be recovered where they are refined, which may be in the country of origin or in an importing nation. The rate of sulfur recovery from refineries is dependent on the environmental regulations where refining is accomplished.

**Substitutes:** There are no adequate substitutes for sulfur at present or anticipated price levels; some acids, in certain applications, may be substituted for sulfuric acid.

<sup>e</sup>Estimated.

<sup>1</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>2</sup>See Appendix B.

<sup>3</sup>See Appendix D for definitions.